Is food security sufficiently integrated in estimates of global biomass potentials for non-food uses?

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Purpose and relevance:

- The substitution of petroleum-based products with biomass-derived alternatives is of high economic and scientific relevance
- Global biomass supply is limited by planetary boundaries → conflict-laden trade-offs between biomass uses are predictable
- Global food security is a critical issue → further investigation whether it is adequately accounted for in the estimates is important

What are ‘realistic’ estimates?

- Biospheric maximum for the energy capacity from aboveground NPP is ~1100 EJ/a (Haberl et al. 2013)
- Currently humans harvest and destroy ~300 EJ/a leaves ~800 EJ/a “untapped”
- The current share of bio-energy use of the global biomass harvested is 22% (IEA 2013) maximum capacity for bio-energy uses would be ~245 EJ/a

Integration of Food Security in the studies

- All studies calculate the agricultural land requirements based on caloric energy needs.
  
  However:
  - Only 8 out of 22 studies disclose their calculation base regarding food diets in 2050
  - Only 6 out of 22 studies provide explicit dietary scenarios
  - Only 7 out of 22 include projected future food prices

- Estimated total caloric intake in the studies range from 2410 kcal/cap/d (vegetarian diet) to 3170 kcal/cap/d (high meat based diets)

  However:
  - OECD current food consumption is 3500 kcal/cap/d this would mean a caloric reduction of 10% to 30% for OECD

- Share of protein in diets is considered in several studies

  However:
  - Balanced nutrition (including vitamins, minerals, micronutrients, phytochemicals etc.) is not considered

AND:

- Food security is only considered via caloric requirements (supply) → other dimensions of food security (i.e., availability, access, utilization, and stability) are only mentioned in 2 studies.

Conclusions:

- A large number of studies overestimate future bioenergy-potentials, as anything beyond 245 EJ/a would most likely mean an expansion of bioenergy production at the cost of other biomass uses
- Most studies lack transparency regarding their underlying assumptions and modelling approaches
- Food security is hardly discussed and integrated from a present-day understanding

This research...

...aims to understand how food requirements and different dimensions of food security are reflected in biomass potential estimations

For this...

...we conducted a systematic literature review of peer-reviewed and “grey” literature focusing on estimates for the year 2050

The studies...

...show wide variations in their estimates ranging from 40 to over 1540 EJ/a
...all claim to account for a sufficient food supply for 2050’s world population
...by a majority predict future potential for energy from biomass to be significantly higher than the current levels

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